

Electrolyzer-Based Hydrogen (H₂) Fueling Station

*Enabling Technology Development and Demonstration Program
High-Efficiency Space Power Systems Project*

TECHNOLOGY OPPORTUNITY

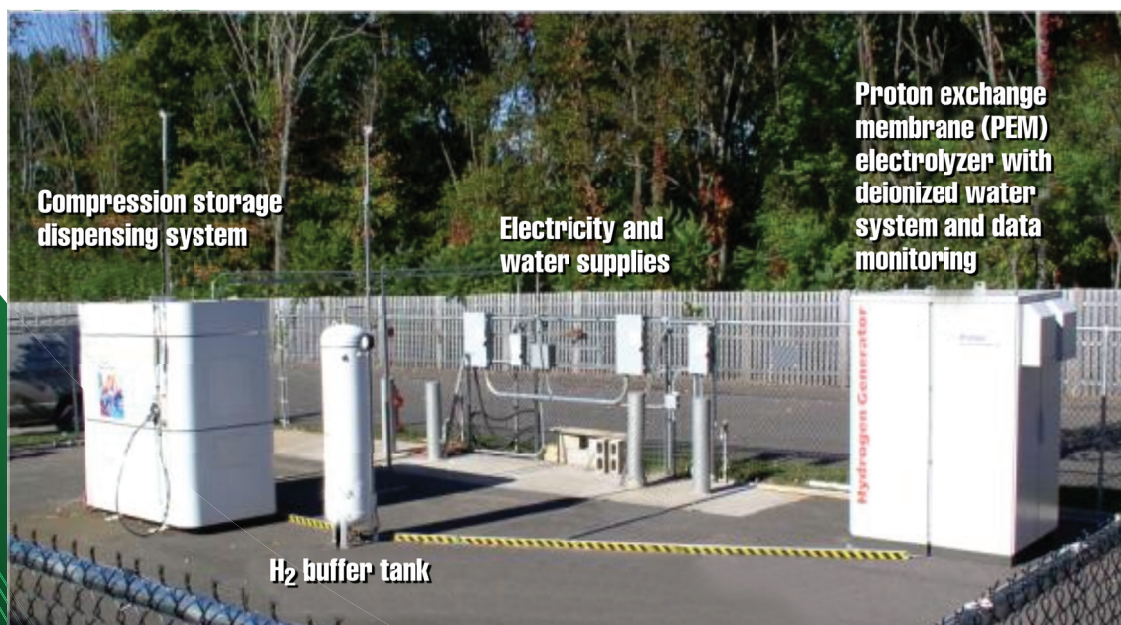
NASA's Glenn Research Center urges companies and universities to consider electrolysis-based systems to generate hydrogen gas for fuel cell vehicles. Electrolysis is a safe and efficient means of generating hydrogen gas directly from water, without emitting harmful pollutants into the atmosphere. Once the hydrogen is generated, it can be used in fuel cell buses, passenger vehicles, or stationary power systems. Replacing diesel and gasoline-powered vehicles on our roads with fuel cell vehicles would mean reducing the use of fossil fuels and reducing harmful emissions. This hydrogen fueling station will demonstrate the ability to safely, efficiently, and cleanly produce hydrogen gas to be used in actual fuel cell vehicles.

BENEFITS

- First hydrogen fueling station in the Midwest to generate its own hydrogen—electrolyzer produces H₂ directly from city water
- H₂-powered fuel cells eliminate emissions—the only exhaust is water and waste heat
- The system is scalable; it can be upgraded to produce additional H₂ as demand increases
- The station is amenable to being powered by renewable energy sources (e.g., solar, wind, and hydro) producing a zero-emissions fuel, from generation through to the tailpipe

APPLICATIONS

- The station will initially produce 12 kg H₂ per day— enough to run a fuel-cell-powered bus in revenue service
- Fuel-cell-powered passenger vehicles
- Utility and military vehicles
- Stationary power systems



HOW IT WORKS

Proton exchange membrane fuel cells, more widely known as PEM fuel cells, are a means of power generation useful for both space and terrestrial applications. The PEM fuel cell converts the chemical energy of hydrogen and oxygen into electrical energy with heat and water as byproducts of the electrochemical reaction. Direct current electricity is produced by drawing electrons through an external circuit from the anode (negative) to the cathode (positive). The hydrogen and oxygen gases are stored in external storage tanks, allowing the fuel cell to generate power as long as fuel is available. For terrestrial applications, air is substituted for stored oxygen, eliminating the need to generate/purchase and store oxygen gas. In a fuel cell bus, the diesel engine is replaced with a fuel cell to generate the power necessary to run the bus. Advantages of replacing the engine with a fuel cell include the elimination of harmful emissions (only heat and water are emitted), reduction of moving parts, and virtually silent operation.

In contrast, the reverse reaction of splitting water into hydrogen and oxygen is called electrolysis. The hydrogen fueling station employs an electrolyzer system to generate the hydrogen necessary to fuel the PEM fuel cell in the bus. The electrolyzer intakes city water, purifies it via an internal deionizing process, and uses electricity to split the water into hydrogen and oxygen gases. The generated hydrogen is then stored in tanks to be pumped to the hydrogen storage tank on the bus for use in the fuel cell. Electrolysis is a safe, efficient, and clean method of generating hydrogen gas since there are no harmful emissions. The uses for the generated hydrogen gas are not limited to only fuel cell buses, but passenger vehicles, utility vehicles, and stationary power systems that employ fuel cells as well.



WHY IT IS BETTER

The application of electrolysis to generate hydrogen gas from water eliminates pollutant emissions. The only emissions from the fuel cell bus are heat and water. The electrolysis system is amenable to renewable energy sources as its source of electricity, which would make it a truly “green” system, further helping to eliminate harmful pollutants and reduce the country’s dependence on fossil fuels. Research at Glenn is focused on improving the reliability and efficiency of PEM fuel cell and electrolysis systems.



LICENSING AND PARTNERING OPPORTUNITIES

Glenn’s Office of Technology Partnerships and Planning seeks to transfer technology to and from NASA to benefit the space program and U.S. industry. NASA urges companies and universities to consider electrolysis-based systems to generate hydrogen gas for fuel cell vehicles.

FOR MORE INFORMATION

For more information about this and other technology licensing opportunities, please contact

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